SURVEY OF BUILDINGS, ELABORATION OF URBAN MAPS, DATABASES FOR DESCRIBING THE SEISMIC BEHAVIOUR OF HISTORICAL SITES

Proceedings

EURAU 2016

European Symposium on Research in Architecture and Urban Design

Ion Mincu University of Architecture and Urbanism
Bucharest, Romania

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Bucharest, September 28 - 30th, 2016

IN BETWEEN SCALES

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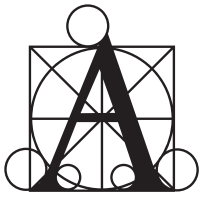

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EURAU 2016 European Symposium on Research in Architecture and Urban Design: In Between Scales

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Proceedings - EURAU2016 is the digital printing version (CD/DVD) of the volume of the full papers accepted for publication at European Symposium on Research in Architecture and Urban Design - EURAU2016. This is the eight edition of the conference, organized since 2004 in Marseille and Lille (2005) (France), Bruxelles-Liege-Mons (2006, Belgium), Madrid (2008, Spain), Napoli (2010, Italy), Porto (2012, Portugal) and Istanbul (2014, Turkey) and now at the University of Architecture and Urbanism "Ion Mincu", Bucharest, on 28th -30th of September 2016. Under the title theme In between Scales, EURAU2016 proposes a debate of the subject defining some new principles of nowadays architectural, design and urban design.

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EURAU 2016
European Symposium on Research in Architecture and Urban Design
Ion Mincu University of Architecture and Urbanism Bucharest, Romania

Introduction

The eighth edition of the European Symposium on Research in Architecture and Urban Design will be held from the 28th to the 30th of September 2016 in Bucharest.

The seminar will take place at the "Ion Mincu" University of Architecture and Urban Planning from Bucharest in collaboration with the institutions that organized the previous editions:

> École Nationale Supérieure d'Architecture de Marseille, on doctoral research (2004);
>
> École Nationale Supérieure d'Architecture et Paysage de Lille, on large scale (2005);
>
> Association des Instituts Supérieurs Brussels-Liège-Mons (IESA), on cultural heritage (2006);
>
> Escuela Superior de Arquitectura de la Universidad Politécnica de Madrid, under the theme cultural landscape (2008);
>
> Facoltà di Architettura dell'Università degli Studi di Napoli Federico II, under the theme venustas (2010);
>
> Faculdade de Arquitectura da Universidade do Porto, on public space and contemporary city (2012);
>
> Faculty of Architecture of the Istanbul Technical University, on composite cities (2014).

The project EURAU is constituted within a network of schools and researchers in Architecture and Urbanism, meeting every two years to share the status of their investigation. In the long-term, it is intended to lead to the creation of a physical meeting and deposit space with all the research undertaken and ongoing in Europe to facilitate the sharing of resources and deepening of knowledge in these scientific areas.

The main concern of the EURAU is to establish itself as a place of debate and discussion of thematic disciplines of Architecture, City and Town Planning.

The theme of EURAU 2016 is "In Between Scales."

Assoc.Prof. Beatrice-Gabriela JÖGER, Arch, PhD, UAUIM, Bucharest, Romania

SURVEY OF BUILDINGS, ELABORATION OF URBAN MAPS, DATABASES FOR DESCRIBING THE SEISMIC BEHAVIOUR OF HISTORICAL SITES

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Abstract

This research, whose ultimate purpose is historic city centers protection through the evaluation of the potential seismic risk to which they are subject, it needs for different disciplines technical support.

As the treated theme is characterized in territorial circle too, importance respect the completeness and the ampleness of the necessary knowledge is obvious. It deals with a job that has picked up and elaborated the contribution of multiple competences, that has broadly been discussed and sharpened in his results, that it gives an adjourned answer so much from the methodological point of view that from the historical-critic.

The development of the research allowed to evaluate and highlight some critical operational, that have emerged by analyzing the new case study identified in the southwest of the historic center of Chieri. Survey work has always been closely reported with the definition of the cognitive context linked. Note therefore means to represent the interest environment geometry, but also to investigate the funding of it historical dynamics, material and characteristic of the behavior of it . This research, whose ultimate goal is protecting the historical urban centers by assessing the seismic potential risk to which they are subject, it is necessary for the different disciplines technical support.

As the subject matter is characterized at a local level also important to respect the completeness and breadth of knowledge required it is obvious. The development of the research allowed to evaluate and highlight some critical operational, that have emerged by analyzing the new case study identified in the southwest of the historic center of Chieri.

The survey was not extended on a single block, as was the case previously examined, but on a larger portion of territory characterized by diversified manufacturing of building. The urban texture of the historic city center of Chieri, the object of analysis, ranges from the Middle Age, with buildings made of brick masonry and horizontal elements in wooden structure, until, in the sixties of Nineteen Century, with modern buildings made of reinforced concrete. Inside the block it is possible to find buildings rich in architectural and construction typical of an urban transformation that, since medieval age, consolidated, through the Baroque period to the end of the nineteenth century, as a result of strong urban and architectural transformations.

The research was developed according to the following steps:

- Identification of a sample portion of land characterized by a wide assortment of historical buildings of different architectural features and different uses, with load-bearing masonry structure and stratigraphy of significant historical periods from the Middle Ages to the twentieth century.

- Geometrical survey of the actual state and return of buildings in their current state with the identification of the buildings, their height, width, openings at ground level and over, survey of common areas such as hallways, stairwells and courtyards.

- Analysis of the fronts, the openings and the development plano-elevation of buildings, the aspect ratio of each architectural element constituting the block;

- Identification of materials, the elements making up the organism resistant, both in material and constructive state, with attention to construction techniques and to the connections between the elements, as defined by the DPCM 09/02/2011, for the assessment and mitigation of seismic risk of the cultural heritage in relation to technical standards for construction as reported in section 4.1.1

- Identification of the hierarchy and constructive relations between the building and the urban context.

- Identification of carriers as unidirectional or bidirectional load-bearing walls, vertical columns or masonry pillars or galleries. The presence of spaces with a significant height interstory and the presence of buildings sleeve simple or double sleeve.

- Identification, where possible, of the areas of discontinuity and inhomogeneities of materials due to different construction phases (additional bodies, cant, substitutions of certain parts of buildings or floors, insertion of new structural elements and balconies etc.).

The symbology overlap has been made necessary by the presence of several elements which characterize and describe the morphological nature of the asset analyzed as the presence of "vertical bearing elements in columns" and at the same time the presence of "environments with significant height interstory". The research is continued by examining not only one block but a larger portion of the territory, located in the historic center of Chieri. The study has uncovered further problems that were analyzed. The development of a new working method consists in the proposal of new symbologies more articulated and with greater detail of information. The deepening of the study led to the differentiation of the openings of the inputs by placing an arrow close to the access driveways and walkways. In the presence of point features vertical was placed a dot, coloured in black if the vertical element is placed in the lower floors (arcades, cloisters, etc.) and in white if the structure is situated at the highest floor (lodges). The presence of buildings of reinforced concrete or the presence of parts bearing walls was represented with a filled crossed line placed at 45 *. After the analysis the end product of the research will be the graphical depiction of the analyzes performed, or a representation of fast and easy reading under the symbols studied

Keywords: Architecture, Seismic risk, Cultural heritage, Mapping, Representation, 3D modelling.

1 THE SCIENTIFIC BASES OF THE SEARCH (Giorgio GARZINO)

Survey activity has always been tightly reported with the definition of the connected cognitive context. This research, whose ultimate purpose is the historic city centres protection through the evaluation of the potential seismic risk to which they are subject, needs of the contribution with different disciplines technical support. The cultural background grown in the former Structural Engineering School directed in the past decades by professor Augusto Cavallari Murat, and followed by the scholars of his team, left a significant mark with the project named *Forma Urbana* [1], from which an innovative method of representing the building and urban structures of historical centers arose. This method generated a standardized graphical representation that in year 1974 was codified by the UNI Norm 7310/74.

In more recent times with reference to the cultural patrimony, the Directive P.C.M. of February 9th 2011 constitutes a deepened scientific and technique reflection on the matter. In these years the literature had registered important improvements [2] [3] [6] [7] [8]. In this renewed cultural climate the General Assembly of the Superior Council of Public Works of April 20 th 2012, with the purpose to answer to the cited Directive, has approved a study preparatory to the elaboration of tools for the application of the normative seismic to the historical settlements.

The present contribution intends to explain an activity of search outstanding in collaboration with the Department of the Civil Protection and with University Laboratories of Seismic Engineering Net (Rete dei Laboratori Universitari di Ingegneria Sismica –ReLUIS-) [9]. The theme of structural and seismic safety requires today that are conjugated knowledge of two cultures remained too long separated. Is now scientific heritage shared the fact of how to the left of the characteristics that describe the mechanical behavior of materials should decline the magnitudes of the efforts and stresses intrinsically linked to the geometry and at the same time a path of a history of the building, in order to know to fully the nature and spend so the specificity of the particular to the general complex. In this renewed cultural climate the General Assembly of the Superior Council of Public Works of April 20th 2012, with the purpose to answer to the Directive P.C.M. February 9, 2011, has approved a study preparatory to the elaboration of tools for the application of the normative seismic to the historical settlements. The proposed job uses of some searches taken place during the years by numerous researchers. In fact, the scientific research proceeds through the contribution of the many diligent and strenuous actors and each report about the state of knowledge at a given time does nothing but mark a further step, small or large, compared to the level of previous knowledge. To forehead of the activity of survey it is possible to pass to a classification of first level, conducted either on the basis of comparative analysis or of simplified analytical models.

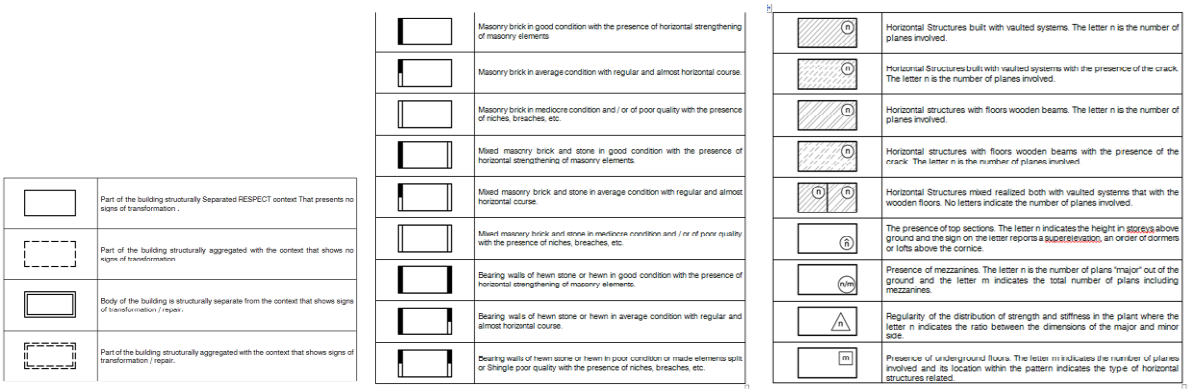

Figure 1. Symbols defining symbols for defining different types of buildings, types of masonries, and for defining horizontal structures built with vaulted systems.

With the purpose to allow the passage to a level of further close examination, the survey campaign not only foresees the elaboration graphic-symbological of logical-deductive data as the harvest and the organization of metric data. This operation, as best documented in the case study presented, is based on the processing of frames and subsequent organization of photographic models 3D, likely to query metric. The model of survey campaign proposed in this research therefore provides the organization of databases multirelational, where the information obtained under the tab CAR.TI.S. they relate to the geometric layout of the building and with the feedback metric that provides the 3D model (from the size of the openings to the ceiling heights of). This wealth of data, scientifically collected and organized, beyond the fact that it constitutes an important analysis of a logical-deductive, then makes possible the preparation of mechanical models-behavioral rather detailed, able to respond positively to the demands of knowledge on which are founded the analysis of seismic risk and protection. After the recent earthquakes, such as the one that destroyed the historic centre of L'Aquila in 2009 which caused very critical damages to buildings and the other of 2012 that occurred in Emilia Romagna, has led to a consciousness of the knowledge of the state of the buildings, their use and their conservation, particularly those undergoing preservation order pursuant to Legislative Decree no. 42⁄2004 against seismic issues.

Although the *Guidelines for the evaluation and reduction of seismic risk of the cultural heritage* in line with the new technical regulations for the buildings date back to 2008 (DM 14 January 2008).

Innovation and attention, creating a database of seismic risk is the subject of official recommendations that have just emanated[1]. The identification card must, in addition to the identification data of the property: name, address, cadastral identification, details of the declaration of interest in accordance with Legislative Decree no. 42/2004, ownership, destination, urban, location, extent and type of intervention should provide a "brief description of the intervention" and indicate whether the same interferes with the supporting structure and the various elements: bearing walls, floors, times, partitions, roof foundations or floors in addition to indicating the need or not an audit structural. Particular attention is paid to the importance of the vulnerability of building types.

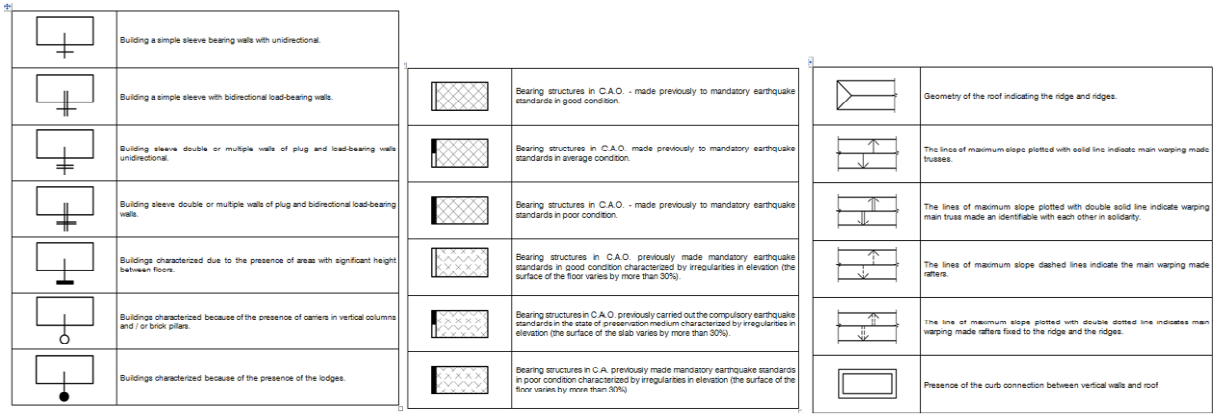

Figure 2. Symbols for defining information about openings, floors structural arrangement, and for defining the organization of the roofing system.

After that, due to the drawing knowledge, it will spring the possibility to compile urban maps (invented to belong to an integrated territorial informative system with data on geophysics, geology, geotechnical design), capable to represent the seismic risk of single city contexts.

It deals with a scientific research in to become and in progress of definition, which however has already clearly fixed its guardianship and safeguard objective: it must be investigated system terms, the only ones which experience has taught us to be effective.

2. A FIELD RESEARCH IN THE HISTORIC CENTER OF CHIERI (Elena Teresa Clotilde MARCHIS)

The research here developed analyzed a small urban center in the Turin area. The chosen place is located in a flat area at the foot of the hilly offshoots of the eastern slope of the hill of Turin and the last layers of the Monferrato hills. The city of Chieri is about 20 kilometers from Turin. The city was founded in the flat area, according to a method of implantation feature of Roman settlements. Chieri also had an intense urban development in medieval well seen especially in the presence of religious buildings of great importance. The presence of civil buildings of medieval times is easy to read in detail in front of the walls, in the presence of wooden coffered ceilings in ribbed vaults. It is not always possible to date precisely the age of the buildings with a simple observation. Sometimes medieval elements may be concealed from operations attributable to later periods, from the Renaissance until the mid-twentieth century, which altered the outer skin and changed the structure.

Figure 3. Satellite view of the historical centre of Chieri

The development of the research allowed to evaluate and highlight some critical operational, that have emerged by analyzing the new case study identified in the southwest of the historic center of Chieri. To reduce the effects of the earthquake, state action focused on the classification of the territory, according to the intensity and frequency of earthquakes of the past, and the application of special rules for construction in seismic areas classified. The Italian anti-seismic legislation, aligned to the most modern standards internationally prescribed technical standards under which a building must endure without serious damage earthquakes without collapsing and less strong earthquakes stronger safeguarding first of all human lives. The measure sets out the general principles on which the regions, in which the state has delegated the adoption of the seismic classification of the territory DLgs 112/1998[2], have compiled the list of municipalities with its assignment to one of the four zones, in danger of decreasing, which has been reclassified in the country[3]. *Earthquakes are rare.* The current Technical Regulations for Construction (Ministerial Decree of 14 January 2008), in fact, changed the role that the seismic classification had for design purposes: for each area - and then municipal area - previously was provided a value of peak acceleration and then the elastic response spectrum to be used for the calculation of the seismic actions. Since July 1, 2009 with the entry into force of the Technical Standards for Construction of 2008, for each building should be referred to a reference acceleration "their" identified according to the geographic coordinates of the project area and a function of life Nominal work. A value of the basic dangers, therefore, defined for each point of the national territory, on a square grid of 5 km of side, regardless of administrative borders.

The seismic classification (seismic zone membership of the town) is only useful for the management of the planning and control of the territory by the authorities (Region, Civil engineering, etc.). http://www.protezionecivile.gov.it/jcms/it/classificazione.wp The need to build a speed mapping of the urban territory aimed at understanding, prevention and methodologies of behavior in case of earthquake is essential to cope with emergencies and the immediate that may occur. In this case is the fundamental understanding of the composition of structures, construction methods, the architectural phases of stratification that often hidden from those existing layers recent. It is also important to identify the nature of the buildings and their actual intended use to feign can keep under control and organize the phases of survey collection and arrangement of the populations in the area in case of earthquake. In critical situations such as those indicated it is very important the availability of buildings functional the needs expressed also, according to their current use. The good knowledge of the area and the availability of these architectures can be of great help to convey the flow of people to safe areas and easy to adapt to situations. Parallel to the good knowledge of architectural structures is important to have a good knowledge of the possibilities of movement and traffic flow. As in critical situations is very important to know which are the buildings, according to their current function, most at risk for non-vehicular flows of people or to secure them, and identification for strategic emergency actions.

The survey was not extended on a single block, but on a larger portion of territory characterized by diversified manufacturing of building. The urban texture of the historic city center of Chieri, the object of analysis, ranges from the Middle Age, with buildings made of brick masonry and horizontal elements in wooden structure, until, in the sixties of Nineteen Century, with modern buildings made of reinforced concrete. Inside the block it is possible to find buildings rich in architectural and construction typical of an urban transformation that, since medieval age, consolidated, through the Baroque period to the end of the nineteenth century, as a result of strong urban and architectural transformations.

The research was developed according to the following steps:

- Identification of a sample portion of land characterized by a wide assortment of historical buildings of different architectural features and different uses, with load-bearing masonry structure and stratigraphy of significant historical periods from Middle Ages to the twentieth century [4] [5].

- Geometrical survey of the actual state and return of buildings in their current state with the identification of the buildings, their height, width, openings at ground level and over, survey of common areas such as hallways, stairwells and courtyards;

- Analysis of the fronts, the openings and the development plano-elevation of buildings, the aspect ratio of each architectural element constituting the block;

- Identification of materials, the elements making up the organism resistant, both in material and constructive state, with attention to construction techniques and to the connections between the elements;

- Identification of the hierarchy and constructive relations between the building and the urban context.

- Identification of carriers as unidirectional or bidirectional load-bearing walls, vertical columns or masonry pillars or galleries. The presence of spaces with a significant height interstory and the presence of buildings sleeve simple or double sleeve.- Identification, where possible, of the areas of discontinuity and inhomogeneity of materials due to different construction phases (additional bodies, cant, substitutions of certain parts of buildings or floors, insertion of new structural elements and balconies etc.). The transition from an abstract scheme, such as that of the categories identified, to the drafting of an important document, required an adjustment sensitivity and a critical interpretation of the situations encountered. Following the speed survey conducted in the first phase of the study, they were identified some critical aspects, because the hierarchization of the information related to the type of construction can vary within each individual building, both in the structure and in the vertical stratification. In the first part of the research, conducted on a sample block of the historical centre of Turin, it was assumed to indicate only the typological features of the building on time, limited to the portion or sleeve examined. By a more in-depth analysis it was considered to investigate more the situation and to indicate the characterization according to a notation superimposed near the openings so as to describe punctually, with greater detail, the architectural object.

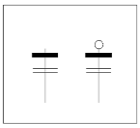

Figure 4. Primary symbology

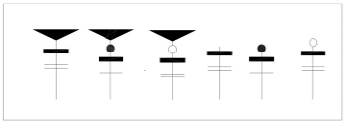

Figure 5. Symbology of the morphological nature of the asset.

The primary symbology overlap has been made necessary by the presence of several elements which characterize and describe the morphological nature of the asset analyzed as the presence of "vertical bearing elements in columns" and at the same time the presence of "environments with significant height interstory". The deepening of the study led to the differentiation of the openings of the inputs by placing an arrow close to the access driveways and walkways. In the presence of point features

vertical was placed a dot, coloured in black if the vertical element is placed in the lower floors (arcades, cloisters, etc.) and in white if the structure is situated at the highest floor (lodges) (Fig. 4-5).

Figure 6. Graphical depiction of the analyses performed, sample carried on a part of the historic centre of Chieri.

The presence of buildings of reinforced concrete or the presence of parts bearing walls was represented with a filled crossed line placed at 45°. After the analysis the end product of the research will be the graphical depiction of the analyses performed, or a representation of fast and easy reading under the symbols studied and elaborated on the basis of the Directive for the assessment and seismic risk reduction. The second phase of research, expand across regions, has identified classes and types of buildings according to use either public or private or organizational and managerial functions and flows of people, all in order to identify places and buildings of larger seismic risk.

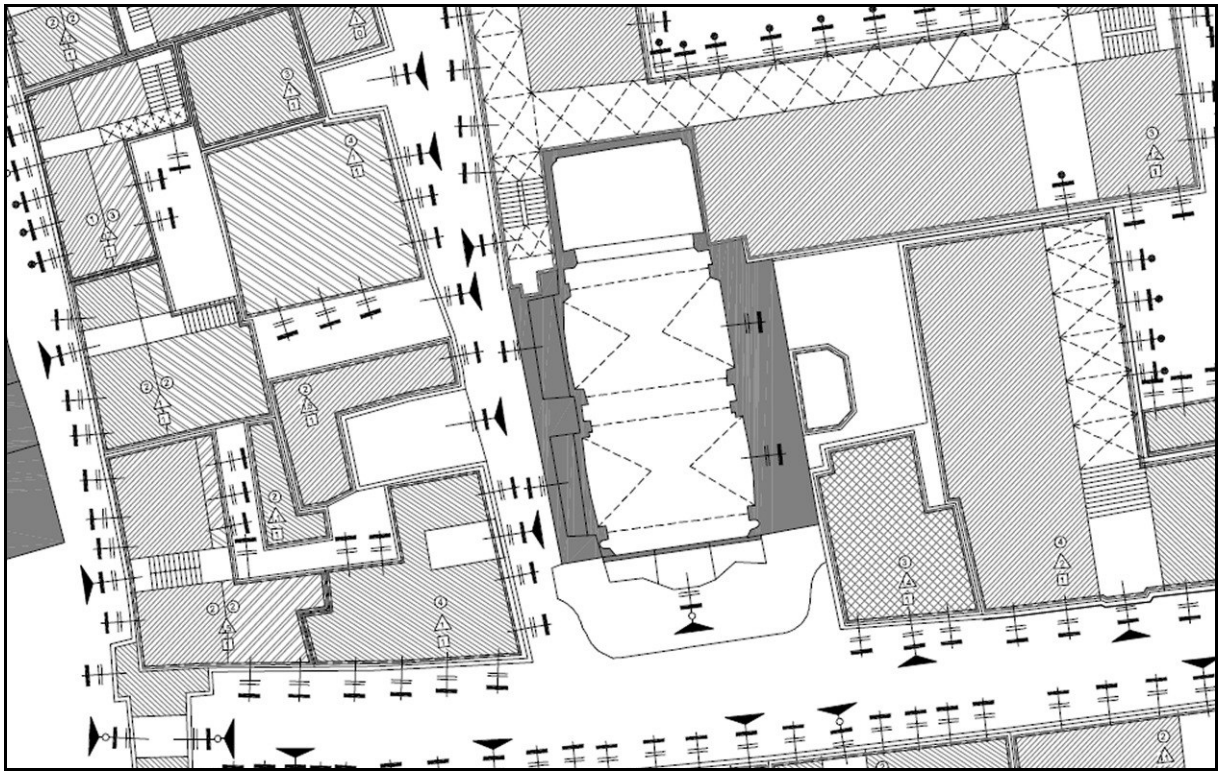

Figure 7. Graphical depiction of the analyses performed, particular.

The analysis has identified the classes of buildings; that subsequently generated a mapping of the territory (Fig. 8) and its colouring, so forming a complex database that allows to filter and interpolate the data of different nature: structural, typological, flow, etc.

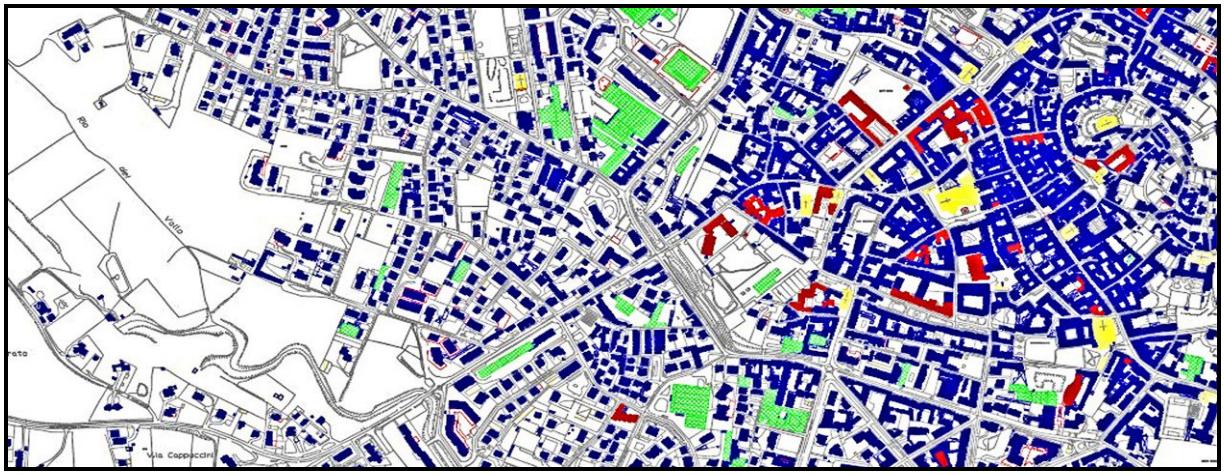

Figure 8. Mapping of the territory, particular.

The database is illustrated in (Fig. 9), and shows some examples of user interface, representing the first phase of the work of data collection, analysis and return of multiple analyses conducted.

The data in this way can be compared and correlated and the user interface can be easily accessed and used even by non-technical users. The research will be expanded and the next step will be the creation of a GIS (Geographical Information System) created on the basis of the database so you can relate and query data, the result of analysis and research, including on thematic maps calling cards and operational intervention analysis as the " CAR.TI.S. Cards ". Today, the CAR.TI.S. can be interrogated in database user interface "masks" depending on filtered data for "FAMILY" and "TYPE" in the building.

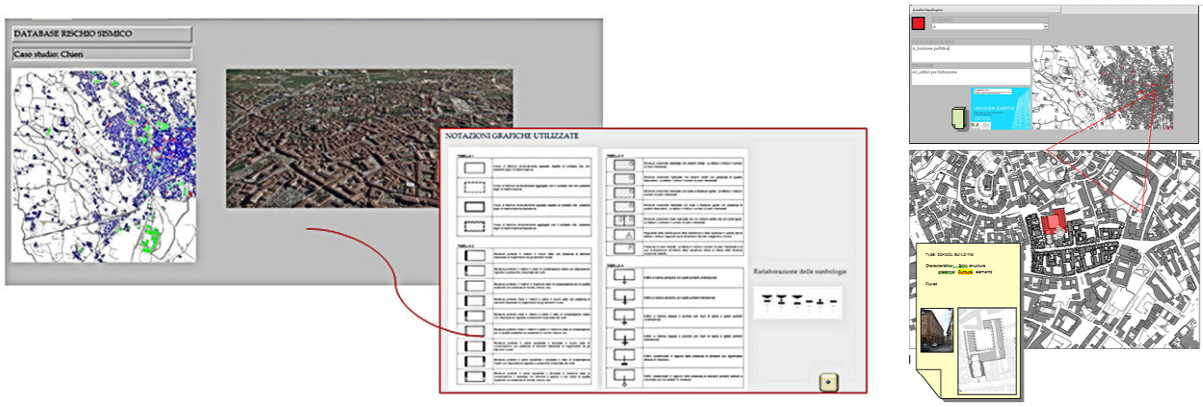

Figure 9. Example pages of database, index and records

The database has the task of being able to query for types of building and in the user interface (Fig. 9) is possible to find two examples of queries. A first filter allows you to select the "function" of the building and display it on a mapping and then select the "type". Zooming on maps you can view and select with the mouse the cell building that you want to interrogate allowing you to view a board containing the features, scanning and 3D visualization of the architectural object, a data CAR.TI.S. reference, etc. For creating a geometric model it was used software photoscan that performs photogrammetric processing of digital images and generates 3D spatial data. Its result is the creation of a 3D model can be edited and queried by which you can get sizes and shapes of architectural order to build structural models. A test done on a portion of the building allows you to obtain a 3D model from which we can extract metric data and display as the structural height of interstory, the size of the openings, the relationship between full and empty. Speed survey in conjunction with a digital model will be the basis of a subsequent structural verification of the building concerned with creating a geometric pattern of the structural elements and a structural model. This research, especially in its

early description of the functions of use of the buildings, beyond a simple characterization of use, is projected into a dimension that goes beyond the simple mapping of structures and become a necessary tool for the management of the dynamics of the public and private spaces. Often in historic buildings, and therefore inevitably burdened with features not meet the latest regulations, they are set for public interest or, in exceptional cases, such buildings can be seen changing their functions. It will thus be of primary interest to the technician, but also for those who hold an administrative role management, to have all information to be able to act in real time with any variations in the use of the buildings themselves.

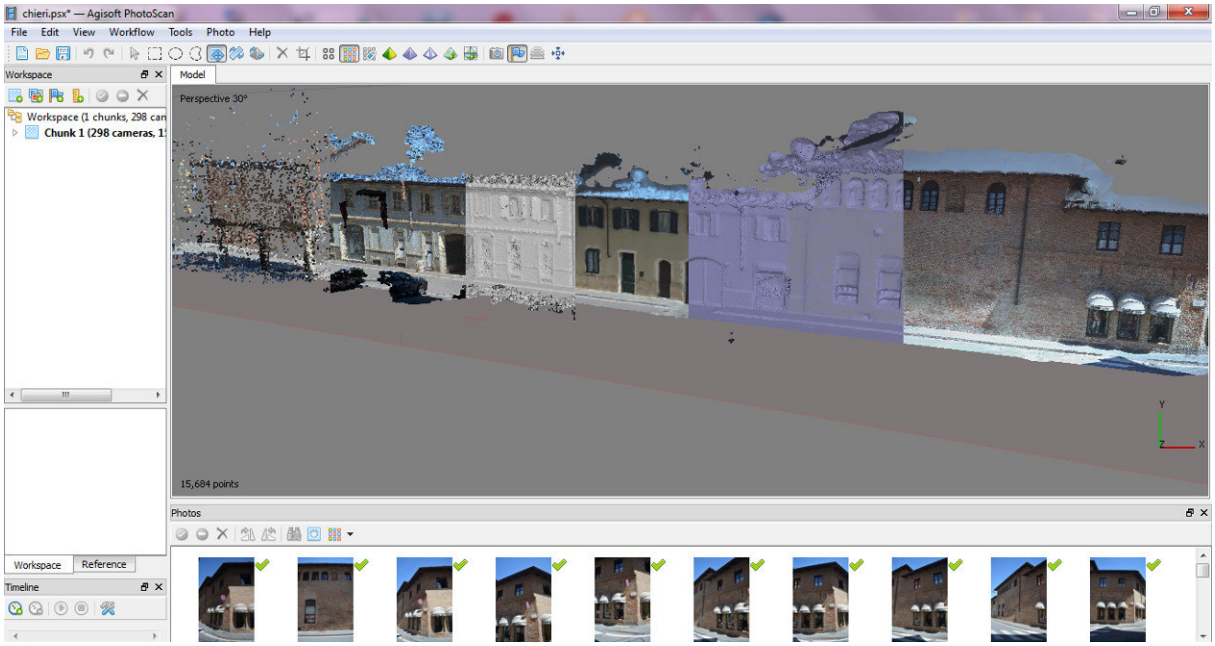

Figure 10. Computer actions for the final model, starting from point cloud data to the mesh structure

Load-bearing walls can be detected if the masonry or stone structures have deterioration and / or degradation, in case of absence or of ineffectiveness of joints, slots and / or recesses or cavities.

The beams, if detectable may be wood, steel or reinforced concrete and depending on the detected material present rot, cracks and / or supports are not suitable.

The covering structure may be constituted by wooden beams, metal beams, or times or by slabs of reinforced concrete. In this case the vulnerability can be due to pushing structures, lack of bracing of the water, in connection with the underlying masonry unsuitable or ineffective connections of the nodes of the truss. As regards the foundations, if known, they can be in masonry or reinforced concrete and vulnerable to sagging bottoms. Finally, as regards the non-structural elements (such as cornices, parapets, chimneys, or projecting elements) it is possible the occurrence of connections is not effective with the structure and detachment, or deterioration.

In the section "From the knowledge of the situations the proposal phase with the study of" mitigation of seismic risk repairs and local interventions "are analyzed:

- Action to reduce the shortcomings of the links-walls walls and floors and walls-related proposals

- Measures to reduce the pressure of arches and vaults and their consolidation, by including chains, masonry buttresses or pads, to tackle with bands of composite material, the achievements of soffits masonry for vacuum pressures, the reduction of extrados loads, the consolidation of the masonry;

- Measures to reduce the excessive deformability of the floors and their consolidation. In this case it can be provided for interventions of lightweight stiffening as the placement of a second plank overlay to the existing one, arranged with trend orthogonal or slotted false. Or the arrangement of reinforcements with crossed straps, with metallic elements, with composite materials;

- Interventions in roofing;
- Projects aimed at increasing the resistance of masonry elements;
- Interventions on pillars and columns;
- Interventions in the foundation;
- Work on non-structural elements;
- Organizational measures;

It all ends with the evaluation of the intervention in order to: invasiveness, effectiveness of performance, chemical, physical, and mechanical compatibility, reliability in performance, controllability of performance, reparability and costs.

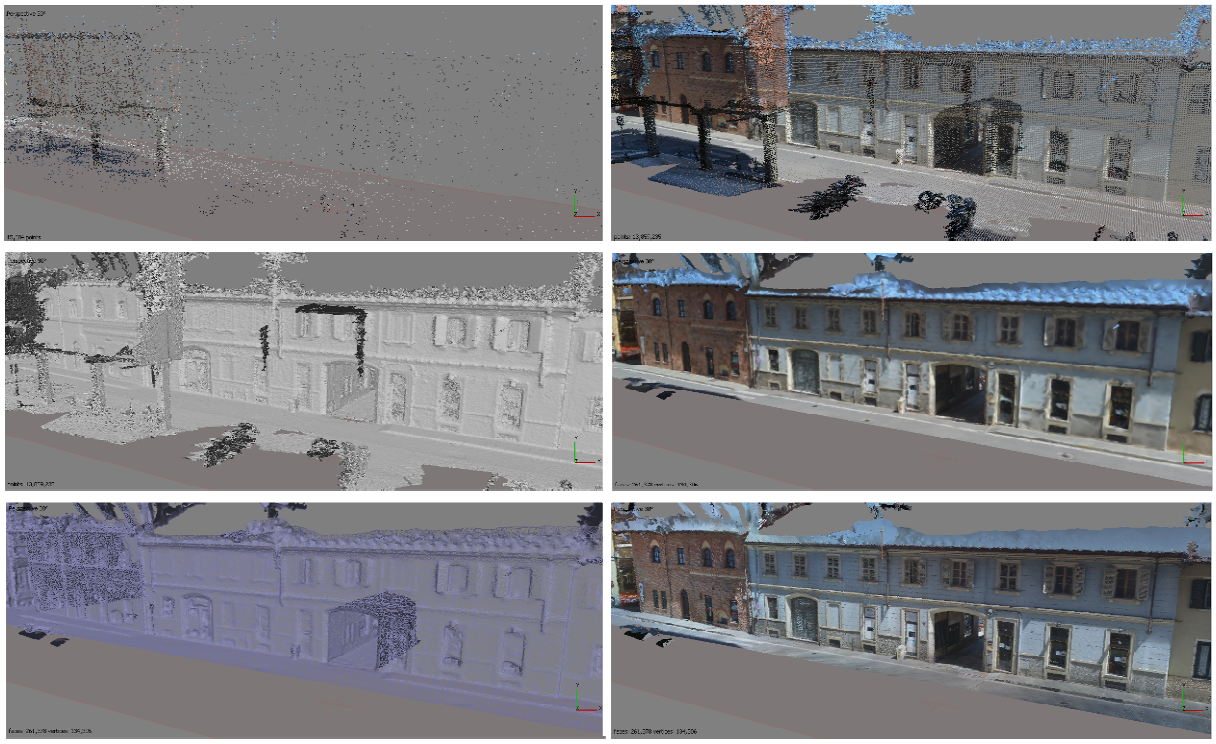

Figure 11. Subsequent operative steps during the creation of the three-dimensional model.

In the analysis of the street examined, reported in Fig.10 -11, starting from 298 photographs[4] a 15.684 point cloud have been generated, that with digital elaboration have produced 13.859.235 points of a dense cloud. The so produced model consisted in a mesh of 2.161.378 faces with 134.306 vertex that led to a 3D model with a real texture.

The speed survey to be performed on ground, due to the nature and dimension of the set of buildings and architectural structure to be taken into account, can be performed with the aid of now well assessed techniques of a “street view” vehicle equipped with scanning cameras or with drones. The so taken pictures can subsequently transformed in the point cloud data usable for a photogrammetric analysis. Among the different software available for this operation the Agisoft Photoscan[5] has been used and it has been found easy to use and reliable in the results obtained by a smart automated data processing. The 3D model so obtained will add to the survey the information necessary for the symbolic codification and for the final mapping, GIS referenced and part of a general database for public utilisation.

3. CONCLUSIONS

In summary the Synopsis Record of seismic risk, which analyzes the structure and inherently intervention on it is going to do, can become a moment of knowledge and reflection, staple of

knowledge flowing in the database of MIBACT (Ministry of heritage, cultural activities and tourism) can be effectively made available for emergency situations in case of disaster.

Collecting cards of seismic risk over the complete territory requires in any case long time, because it is drawn up only in the presence of a restoration or maintenance, by skipping all those buildings that have already been restored prior to 1 September 2015 and those who have undergone renovations.

The mapping, or speed survey, of an area is an element of knowledge even if not becomes more specific in the history of a building and of its conservation. However the combination of the two types of investigation can become a fundamental element of knowledge of the area and of its building and architectural heritage, and will be a support for the activities of emergency teams and of Civil Protection in the event of disasters. In a country like Italy, strongly influenced by seismic risk, if from one hand the geodynamic researches since long times have mapped the territory on the basis of the earthquakes effects [2], the territory and urban mapping from the point of vierw of architectonical and structural characteristics in a perspective both of seismic resistance and of public / private utilization is a new deal. The approach here adopted has its historical grounds in the urban mapping graphic method adopted at the mid Twentieth Century by the Civil Engineering School of the Politecnico di Torino [1] and now on the same graphic base has been transferred in the multidimensional ambient allowed by the actual computer facilities. But, at the end of this contribution that after the general theory, in accordance with the general norms and laws, has been proofed and verified on the field. And the general and final products, i.e. the coloured maps will give an immediate idea of the field to interact in case of tragic disasters. The practical aspect of the results an their friendly usability can help to trust in the possible use extended to large scale. Only in this case the effort of the initial research will offer the practical effects for a safer utilization of our urban spaces. Because the memory of the past not only is matter for erudition and for celebrating glorious times, but is mandatory for a complete consciousness of the present time, and for a critic view of the future.

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[1] Circular No 15 of 30 April 2015 of the Ministry of Cultural Heritage and Activities issued by the General Secretariat provides that, with effect from 1 September 2015, applications pursuant to Art. 21 of the aforementioned Legislative Decree no. 42/2004, for authorization to work on goods subject to protection, must be accompanied by a Synoptic Record of structural and architectural.
The Synopsis Record has been prepared according to the directives of the Council of Ministers of 9 February 2011 on the *Valutazione e riuduzione del rischio sismico del patrimonio culturale con riferimento alle Norme tecniche per la costruzione* (Assessment and mitigation of seismic risk of the cultural heritage with reference to technical standards for the construction) by decree of the Ministry of infrastructures and transportation 14 January 2008 ".

[2] Legislative Decree no. 112 of 1998 and Decree of the President of the Republic n. 380 of 2001 - "Consolidated Standards for Construction"

[3] Zone 1 - The most dangerous part. May occur strong earthquakes, Zone 2 - This area may experience strong earthquakes, Zone 3 - In this zone can occur strong earthquakes but rare, Zone 4 - And ' the least dangerous area.

[4] The photographic campaign for the survey and modelling has been performed with the collaboration of Ugo Comollo in the staff of

Department of Architecture and Design of Politecnico di Torino.

[5] A stand-alone software product that performs photogrammetric processing of digital images and generates 3D spatial data to be used in GIS applications.